S. C. Pappas M. M. Fisher

Preventing Hepatitis B in Health Care Workers

SUMMARY

Exposure to hepatitis B virus (HBV) infection is a potentially serious occupational hazard for health care workers. Data indicate an increased risk of HBV infection in health care workers. This risk appears to be related to the frequency of contact with patients' blood and exposure to high risk patient populations. Strategies available for preventing HBV infection in the health care setting include HBV vaccine, which is the most efficacious and practical strategy. In view of the potential consequences of HBV infection, health care employers have a responsibility to provide education, serological testing and vaccination. Health care workers have a responsibility to use these programs, and to assess their own risk of infection. (Can Fam Physician 1985; 31:1941-1944.)

SOMMAIRE

L'exposition à une infection causée par le virus de l'hépatite B (HBV) constitue un risque potentiellement dangereux pour les travailleurs de la santé. Les données disponibles indiquent une augmentation du risque d'hépatite chez ces mêmes travailleurs. Le risque semble relié à la fréquence des contacts avec le sang de ces patients et à l'exposition de cette population à haut risque. Pour prévenir cette infection, les stratégies disponibles incluent le vaccin contre le virus de l'hépatite B, lequel constitue la méthode la plus efficace et la plus pratique. Etant donné les conséquences potentielles de cette infection, les employeurs ont la responsabilité d'éduquer, de fournir les tests sérologiques et le vaccin. Les travailleurs de la santé pour leur part ont la responsabilité d'utiliser ces programmes et d'évaluer leur propre risque d'infection.

Key words: Hepatitis B, prevention, health care workers

Dr. Pappas is a hepatologist and member of the Liver Disease Program, Sunnybrook Medical Centre, and assistant professor of medicine at the University of Toronto. Dr. Fisher is Director of the Liver Disease Program and Chief of the Gastroenterology Division, Sunnybrook Medical Centre, and associate professor of medicine at the University of Toronto. Reprint requests to: Dr. S. C. Pappas, Suite 964, H-Ground, Sunnybrook Medical Centre, 2075 Bayview Ave., Toronto, ON. M4N 3M5.

HEPATITIS B virus (HBV) infection is a major, worldwide problem. While HBV infection in Canada is not as common as in other parts of the world, it remains one of the most significant reportable infectious diseases.[1] Furthermore, exposure to HBV infection is a serious occupational hazard for health care and dental workers. While most people who develop HBV infection have an acute self-limited illness with no residual sequelae, approximately 5% develop chronic HBV infection, which may be associated with active liver disease and cirrhosis.[2] Chronic carrying of the hepatitis B virus has been strongly associated with an increased risk for hepatocellular carcinoma.[3] The lack of effective medical treatment, the potential for serious medical consequences and the availability of a safe and effective vaccine make the occupational exposure of HBV infection a concern to all health care workers and administrators.

Mode of Transmission

Type B hepatitis is spread by the parenteral route.[2-4] The risks posed to the health care worker by needle stick injuries and frequent contact with blood during venipuncture, establishment of intravenous lines, etc. are obvious. Less commonly described, but most important to the health care worker, is the mode of covert, or inapparent, parenteral spread; by contact with other biological fluids of HBV carriers (i.e., saliva, semen, sputum) when there is a break in the skin or mucus membrane. The break may not be apparent and this mode of transmission accounts for HBV infection in people without a history of parenteral exposure.

Serological Tests

Interpreting the serological tests of HBV infection is straightforward if the serological events are known.[2,4] After

a variable incubation period (40-180 days, average 75 days), hepatitis B surface antigen (HBsAg) appears in the blood, usually just before clinical and biochemical illness. With recovery, the patient develops antibodies to the HBsAg and hepatitis B core antigen (HBcAg). These antibodies persist for years, although in some people anti-core antibodies (anti-HBc) or anti-surface antibodies (anti-HBs) become undetectable. Chronic HBV infection results when the patient remains HBsAg positive, despite developing the non-neutralizing anti-HBc (see Table 1).

The Occupational Hazard

With widespread and reliable serological testing, several studies of HBV serology in health care workers confirmed the occupational hazard of HBV infection.[5-7] In the United States, the prevalence of chronic HBV infection (i.e., HBsAg in blood) is approximately 1% in health care workers. Serological markers indicating previous exposure to HBV, are found in about 15-20%.[5] Current HBV infection is therefore five to ten times more common in health care workers than in the general population. Previous infection is two to five times more common in health professionals. Similar frequencies exist for Canadian health care workers, including dentists.[7]

However, risk is not uniform among health care workers. For example, 15% of emergency department nurses, intravenous team members, and laboratory staff have a serological marker of current or previous HBV infection. The same markers are found in only 5% of general ward nurses and medical house officers. This is the same incidence as that for the blood donor population, the group traditionally used to reflect the general population. Epidemiological study has indicated that differences in prevalence are largely related to the frequency of contact with patients' blood.[5] Another important factor, which has not been addressed in any large survey, is the patient population. The prevalence of HBV infection differs between various ethnic and social groups, and so it seems reasonable that the risk of infection in the health care worker will parallel the prevalence of HBV infection in the patient population being served. High risk patient populations include male homosexuals, dialysis, hematology and oncology unit patients, institutionalized, mentally retarded patients, intravenous drug abusers, patients requiring repeated transfusion of blood products (e.g., hemophiliacs, thalassemics) and immigrants from areas with high HBV endemnicity (e.g., Asia, Africa, Mediterranean basin, etc.). Other variables are population age and geographic setting. Health workers in a rural or suburban area serving many pediatric patients are at lower risk than those in a large city serving many adults. A suggested classification for the risk of HBV infection in health care workers is shown in Table 2. Health care workers should try to assess their own risk; for example, a venipuncture technician working in a laboratory serving a large, urban population of oriental patients can assume that the risk of HBV infection is probably very high. The same job in a laboratory serving a predominantly suburban, white population is associated with a lesser (but still increased) risk of infection.

Unfortunately, there are no good, objective data about the precise risk of HBV infection in health care workers outside the hospital setting. However, if they are exposed to patients' body fluids and high risk patient populations, their risk will not be significantly less than that for hospital workers.

Preventing HBV Infection

Prevention strategies can be grouped into three areas: basic hygiene, passive immunoprophylaxis and active vaccination.

Basic Hygiene

A few basic, simple measures are most important. Hand washing, protective gloves when handling high risk specimens, extra care to avoid needle stick injuries when taking blood, identifying and isolating other potentially infectious fluids and needles, and basic common sense can help prevent infection.

TABLE 1
Interpretation of Serological Markers of HBV Infection

Results			Interpretation
HBsAg	Anti-HBs	Anti-HBc	
+	−	−	Early acute hepatitis B
+	−	+	Acute or chronic HBV infection
+	+	+	Acute or chronic HBV infection
−	+	+	Previous HBV infection and recovery
−	−	+	Previous HBV infection*
−	+	−	Previous HBV infection (long ago) or immunization with HBV vaccine

* Low titer suggests infection long ago; high titer is compatible with early recovery phase or 'low level' carrier state (see reference 4).

TABLE 2
Risk of HBV Infection in Health Care Workers

High Risk
Emergency department nurses/staff
Nephrology/dialysis staff
Hepatology unit staff
Lab staff (Biochemistry, hematology, blood banks)
IV/venipuncture team
Pathology staff
Oral surgeons

Intermediate Risk
OR/ICU staff
Ambulance attendants
Oncology unit staff
Sexually transmitted disease clinic staff
Morgue attendants
Medical and surgical house officers*
Anesthesia staff*
Dental care staff
Medical/nursing students

Low Risk
General ward nurses
Dietitians
Physio-occupational therapists
Respiratory technologists

* These groups may be in an intermediate to high risk category.

Passive Immunoprophylaxis

Hepatitis B immune globulin (HBIG), also known as hyperimmune globulin, is a gamma globulin preparation containing a high titer of anti-HBs. In the health care setting, HBIG should be administered following needle stick or mucosal exposure (i.e., blood on abraded skin or mucosa), when the patient is known to have HBV infection and the health care worker is not immune to HBV. The recommended dose is 0.05-0.07 ml per kg intramuscularly as soon as possible within seven days of exposure and again 25-30 days later.[8] If the patient's and/or health care worker's hepatitis B status are unknown, HBIG administration should be delayed until they are determined, assuming the results can be obtained in four to five days. The blood for serological testing must be drawn before administering HBIG. No immunoprophylaxis is needed if the health care worker is already immune to hepatitis B. If the results of serological testing in the health care worker cannot be obtained within four to five days and the patient is known to be HBsAg positive, the health care worker should receive the first dose of HBIG. The need for the second dose should be determined by the test results.

HBIG cannot be used for pre-exposure prophylaxis, because the anti-HBs antibodies do not persist. This would be an expensive and impractical approach, especially in view of the availability of a safe and effective vaccine.

Administration of HBIG and HBV vaccine at the same time (but not at the same site) does not interfere with the response to the vaccine. Combined passive and active immunoprophylaxis is probably the ideal strategy for the susceptible health care worker exposed to HBV.[8] While this may contribute to the anxiety often attending HBV exposure, heightened awareness of the problem may improve health care workers' compliance and interest in the HBV vaccine.

Active Prophylaxis

A vaccine for active prophylaxis against HBV infection is now available. This vaccine, prepared from purified HBsAg, is non-infectious and induces high levels of protective anti-HBs in the recipient. The vaccine is extremely effective, with an excellent safety record.[9-11] Because the vaccine is obtained from human HBsAg carriers, there have been concerns about transmission of other diseases via the vaccine. These concerns have not been proven valid; in particular, there is no increased risk of AIDS in vaccine recipients.[11] The rigid preparation procedure for the HBV vaccine inactivates all known infectious agents including HTLV-III virus, the agent implicated in causing AIDS.[12] Accordingly, the most important strategy for preventing HBV infection in health care workers is vaccination of those at risk.

The current available vaccine (Heptavax B, Merck Sharp and Dohme) is administered in three doses of one milliliter each, intramuscularly in the arm, at intervals of one and six months. This results in a good seroconversion response in 90-95% of healthy adults. Anti-HBs persist at high levels probably for at least five years; however, the precise timing of 'booster shots' remains to be determined. The vaccine should not be frozen at any time and should not be administered in the buttocks—this site has been associated with a low seroconversion rate in health care workers in Canadian vaccination programs.[13, 14]

Institutional Approach

Hospitals and other health care employers should offer educational programs, voluntary serological testing, and vaccination programs for HBV infection. Certain legal aspects of hepatitis B immunization programs have been reviewed in a recent report on keeping health care workers healthy.[15]

Education of health care workers can be accomplished in many ways. Several programs have adopted a multimedia approach with brochures, talks by experts, and the liberal use of in-service presentations to high risk groups in the hospital setting. Printed material is available from the Canadian Liver Foundation (42 Charles St. W., Suite 510, Toronto, ON. M4Y 1T4) and product brochures and other audiovisual aids are available from Merck Sharp and Dohme. Health care workers in both hospital and other settings should have access to this educational material.

A voluntary serological testing program should be established to test health care workers for markers of current and previous exposure of HBV. Ideally, testing should include determination of HBsAg, anti-HBs and anti-HBc. However, some health care workers are reluctant to undergo HBsAg testing, in view of the unclear legal and occupational implications of a positive test result. In this case, only the immune status should be determined, measuring both anti-HBs and anti-HBc. The entire issue of the HBsAg-positive health care worker is difficult and controversial;[16] available data suggest that the practical risk of health care workers transmitting HBV infection to a patient is insignificant. They should therefore not be excluded from any patient care setting.[17]

HBV vaccine should be offered if both antibody tests are negative or if a health care worker refuses serological testing. If either antibody test is positive in significant titer, vaccination may be unnecessary. Three things should be kept in mind.

1. Chronic carriers of HBV will usually be identified only through testing for HBsAg.

2. The level of anti-HBs antibody must be determined, since many health care workers have a low level of anti-HBs antibody.[18] This low level anti-HBs is detectable by the available testing kits, but it is not protective. Health care workers should be vaccinated if their level of anti-HBs is less than a sample-to-normal ratio of ten, using the commercially available test kit AUSAB (Abbott Laboratories) or its equivalent.

3. The vaccine can be administered without serological testing. This is not cost effective in the health care worker population, since people who already have antibodies will be vaccinated unnecessarily.[19] However, no harm will be done if a carrier or immune person is vaccinated. This strategy should be used if a person will accept the vaccine but not serological testing.

We recommend post-vaccination testing of anti-HBs approximately six months after the last injection, to detect the less than 5% of people who do not respond to the usual vaccination protocol. Non-responders may be revaccinated with an additional one to two doses of one milliliter each. Vaccinated health care workers should probably have yearly anti-HBs determination and/or be offered the appropriate booster protocol when it is clearly determined; precise recommendations should be available soon.

An important part of initiating a program should be careful surveillance of the results of serological testing. This gives an idea of the actual risk of HBV infection for a specific local occupational setting. In view of the different activities and patient populations in different health care settings, data on the prevalence of HBV exposure obtained in one setting may not be applicable to other settings. While caution must be exercised in the statistical interpretation of such data, especially when small numbers are involved, certain health care institutions or employers may find that the risk of HBV infection in their health care workers is no greater than that of the general population, and that a HBV infection testing/vaccination program is unnecessary. However, in view of the safety of the HBV vaccine and the potentially serious consequences of HBV infection, HBV infection testing and vaccination should be available in most if not all health care settings.

Individual Approach

Health care workers should attempt to determine their own personal risk of HBV infection.

All health care workers should have their HBV serology status determined. Despite the presently unclear implications of a positive test, HBsAg testing is recommended, because identification of chronic carriers can be very important. A chronic carrier may have underlying liver disease, is a risk of infection to others, especially sexual partners, and is at risk for hepatocellular carcinoma. Furthermore, it is extremely important that health professionals understand the need for postnatal immunoprophylaxis of an infant born to a chronic carrier mother. If serological testing indicates susceptibility to HBV infection, the health care worker should review his or her work setting. A simple scheme, appropriate for both hospital and non-hospital settings, is to ask the following questions:[20]

- Is your job in a general hospital?
- Are you exposed to adult patients rather than children?
- Do you work in a large metropolitan centre?
- Does your job involve exposure to significant numbers of patients from groups who are recognized as having an increased risk of HBV infection?
- Does your job involve exposure to patient blood or blood products?

If the answer is 'yes' to any of the questions, the risk of HBV infection is increased.

Vaccination is recommended if the individual risk of HBV infection is high or intermediate. If it is low, the decision becomes a personal one, which will vary from individual to individual.

Conclusion

HBV infection remains a serious occupational hazard for health care workers, both in the hospital and non-hospital setting. In view of the recognized high risk situations, the potential for serious medical consequences, the ability to determine susceptibility to HBV infection, and the availability of a safe and effective vaccine, health care employers have a responsibility to provide appropriate educational and vaccination programs. Employers have a responsibility to use these programs. ◉

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